The Second International Assessment of Educational Progress:

Focus on B.C.

MINISTRY OF EDUCATION AND
MINISTRY RESPONSIBLE FOR MULTICULTURALISM

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The Second International Assessment of Educational Progress: Focus on B.C.

MINISTRY OF EDUCATION AND
MINISTRY RESPONSIBLE FOR MULTICULTURALISM
AND HUMAN RIGHTS
ASSESSMENT, EXAMINATIONS AND REPORTING BRANCH
VICTORIA, BRITISH COLUMBIA
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HIGHLIGHTS

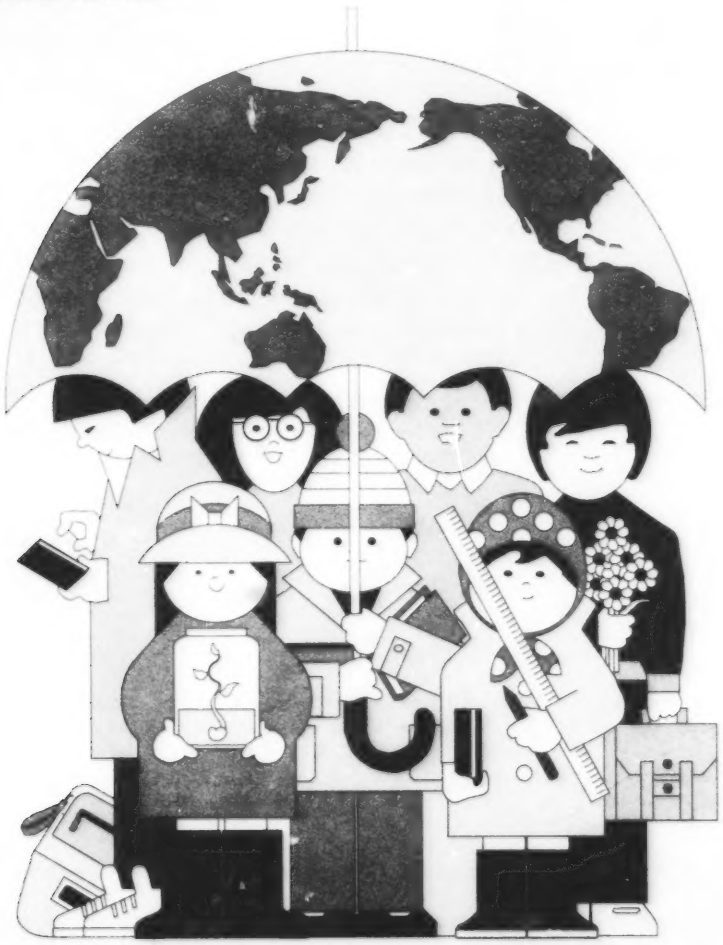
- British Columbia students performed very well on the IAEP II.
- British Columbia students ranked first in mathematics, and second in science, among the English-speaking 13-year-old students.
- British Columbia students performed better on the science components of the assessment than they did on the mathematics component, when compared to other jurisdictions.
- British Columbia 13-year-old students excelled in the content area of Nature of Science, and in the cognitive process area of Integrating Knowledge.
- Nine-year-olds from British Columbia ranked first in the topic area of Earth and Space Sciences.
- British Columbia 9- and 13-year-olds excelled in Data Analysis, Statistics, and Probability in the mathematics components of IAEP II.
- When compared with jurisdictions participating in the first IAEP, British Columbia's position was unchanged, except that Korea scored higher than British Columbia in science in IAEP II.
- About 90 per cent of the students from British Columbia agree that mathematics and science are equally important for boys and girls. There are no significant differences between the boys' scores and the girls' scores, except in the science assessment of 13-year-olds, where the boys significantly out-performed the girls.
- As in most jurisdictions, British Columbia students who watch five or more hours of television per day did not perform as well on the IAEP II as did students who watch less than five hours of television per day.

ACKNOWLEDGMENTS

The Ministry of Education and Ministry Responsible for Multiculturalism and Human Rights would like to thank the students and educators whose time and effort made British Columbia's participation in the Second International Assessment of Educational Progress a success.

INTRODUCTION

In 1990-91, about 175,000 students from 20 countries, including more than 6,000 students from British Columbia, participated in the Second International Assessment of Educational Progress (IAEP II) (see Participants, page 5). The Assessment collected information from countries and provinces about what students know and what they can do. It was designed to compare student performance in various jurisdictions, identify cultural and educational differences, and determine the relationships that may exist between level of performance and these cultural and educational factors.



Subject Areas

The 1990-91 assessment surveyed the performance level of:

- 13-year-olds in science and mathematics (33 and 34 jurisdictions respectively from all 20 countries);
- 9-year-olds in science and mathematics (19 jurisdictions from 14 countries);
- 13-year-olds in a performance-based assessment. This involved assessing their ability to use equipment and tools to solve mathematics and science problems (11 jurisdictions from 5 countries);
- 13-year-olds in a short probe of Geography (21 jurisdictions from 9 countries).

British Columbia students participated in all components of this assessment.

The international reports, *Learning Mathematics* and *Learning Science,* were published in February, 1992. The international reports and this report only discuss the results for the 9- and 13-year-old science and mathematics assessments. International results of the Geography Probe and the Performance Assessments will be published separately in the Summer of 1992.

Participants

Most participating countries tested nation-wide, although some countries restricted their testing to certain provinces and/or language groups. Other populations had low participation rates.

British Columbia's 13-year-old student population was drawn from 107 schools of 110 schools contacted for participation; the 9-year-old student population was drawn from 113 schools of 121 schools contacted for participation.

Approximately equal numbers of boys and girls were included in each sample.

CANADIAN JURISDICTIONS:

Alberta
British Columbia
Manitoba (English)
Manitoba (French)[6]
New Brunswick (English)
New Brunswick (French)
Newfoundland
Nova Scotia
Ontario (English)
Ontario (French)
Quebec (English)
Quebec (French)
Saskatchewan (English)
Saskatchewan (French)[6]

OTHER JURISDICTIONS:

China[3,4]
England[2]
Fortaleza, Brazil[3]
France
Hungary
Ireland
Israel (Hebrew)[5]
Emilia-Romagna, Italy[1]
Jordan
Korea (South)
Mozambique[2,3]
Portugal[1,3]
Sao Paulo, Brazil
Scotland[1]
Slovenia
Soviet Union (Russian)[5]
Spain (Spanish)[5]
Switzerland[4]
Taiwan
United States[1]

1 Combined school student participation rate between .70 and .80, interpret with caution
2 Combined school student participation rate below .70, interpret with extreme caution
3 In-school population only, fewer than 90% of 13-year-olds
4 Selected provinces only
5 Dominant language only, fewer than 90 % of 13-year-olds
6 Including French Immersion

NOTE: Combined results for Canada and Brazil are also reported in Figures 1 to 4.

History of IAEP

The First International Assessment of Educational Progress, IAEP I, was administered in 1988 to 13-year-olds in six countries (Ireland, Korea, Spain, the United Kingdom, the United States, and Canada). Canada was represented by four provinces (British Columbia, Ontario, Quebec, and the two New Brunswick school systems.) English and French populations were assessed separately in all provinces other than British Columbia.

On that mathematics assessment British Columbia ranked third after Korea and Quebec (French). Korea's average score was significantly higher than the scores of both Quebec (French) and British Columbia; the difference between the scores of Quebec (French) and British Columbia was not statistically significant. On the science assessment British Columbia ranked first, just ahead of Korea. The difference between these two populations was not statistically significant; however, Korea and British Columbia were significantly ahead of the other populations. Results were reported in *A World of Differences*, the principal report of IAEP I.

While the first IAEP constructed "proficiency scales" using sophisticated statistical manipulations to report the results, IAEP II used "percentage correct". Because these different approaches were used, no direct comparison of results for British Columbia from the first assessment to the second assessment can be made. Educational Testing Service (ETS, Princeton, New Jersey) does plan to examine the possibility of using Item Response Theory (IRT) scaling techniques with the IAEP II data, and may publish these results in the future.

Differences Between Average Scores: Statistical Significance

Figures 1, 2, 3 and 4 show the differences between the average performances of all participating jurisdictions. Each of these average values is an estimate of what the average performance of all 9- or 13-year-olds in that jurisdiction would be if they had all taken the test, after excluding certain groups of special education and second language students. These estimates, generally based upon about 1500 students but only about 100 schools, are subject to sampling error (meaning that another random sample would produce a different average). A statistical significance test indicates if the difference between two average scores may be due to the sampling process, or can be accepted as a real difference.

Comparisons between jurisdictions are based upon 95% confidence that none of the differences reported as being significant is due to sampling error. (This is known as the Bonferroni multiple comparisons approach.)

It is quite common for a difference of 2 per cent to be significant in one comparison, while a difference of 4 per cent is not significant in another case. Several factors influence the confidence we can have in a difference being real. These include the reliability of the measure and the size and homogeneity of the samples, as well as the size of the difference.

IAEP II Test Construction

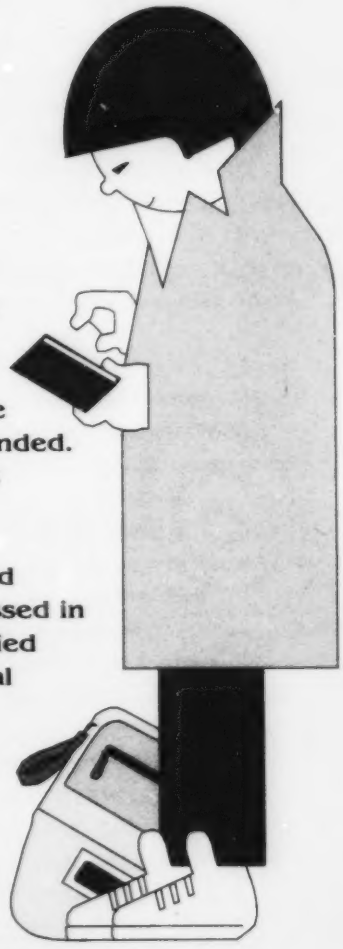
The assessment instruments used in IAEP II are the product of a joint effort involving all participating countries and provinces. Representatives from all jurisdictions agreed on a description of topics and cognitive processes that were both taught in their schools and age appropriate. This description formed the basis for the assessment. The topics included in the assessment are neither given equal emphasis, nor taught on the same schedule in all jurisdictions. The importance ascribed to what was covered and what was not covered by IAEP II varied considerably from jurisdiction to jurisdiction.

All participating jurisdictions were invited to submit items for possible use in IAEP II, resulting in a pool of over 1500 items. These items were then submitted to all participants for judgment as to their appropriateness for IAEP II. Highly rated items were then pilot tested in all jurisdictions, leading to a final selection and editing process. Finally, all translations were verified and national editing was performed. The national editing resulted in a common Canadian English version that was distinct from both the English and American versions.

Students were also asked to complete questionnaires that asked for information about their experiences at home and school. School and jurisdiction co-ordinators also answered questionnaires about their schools and jurisdictions.

ASSESSMENT RESULTS OF THIRTEEN-YEAR-OLDS

The Second International Assessment of Educational Progress tested performance in mathematics and science, and surveyed students about their homes, schools, and leisure activities.



The Mathematics Assessment

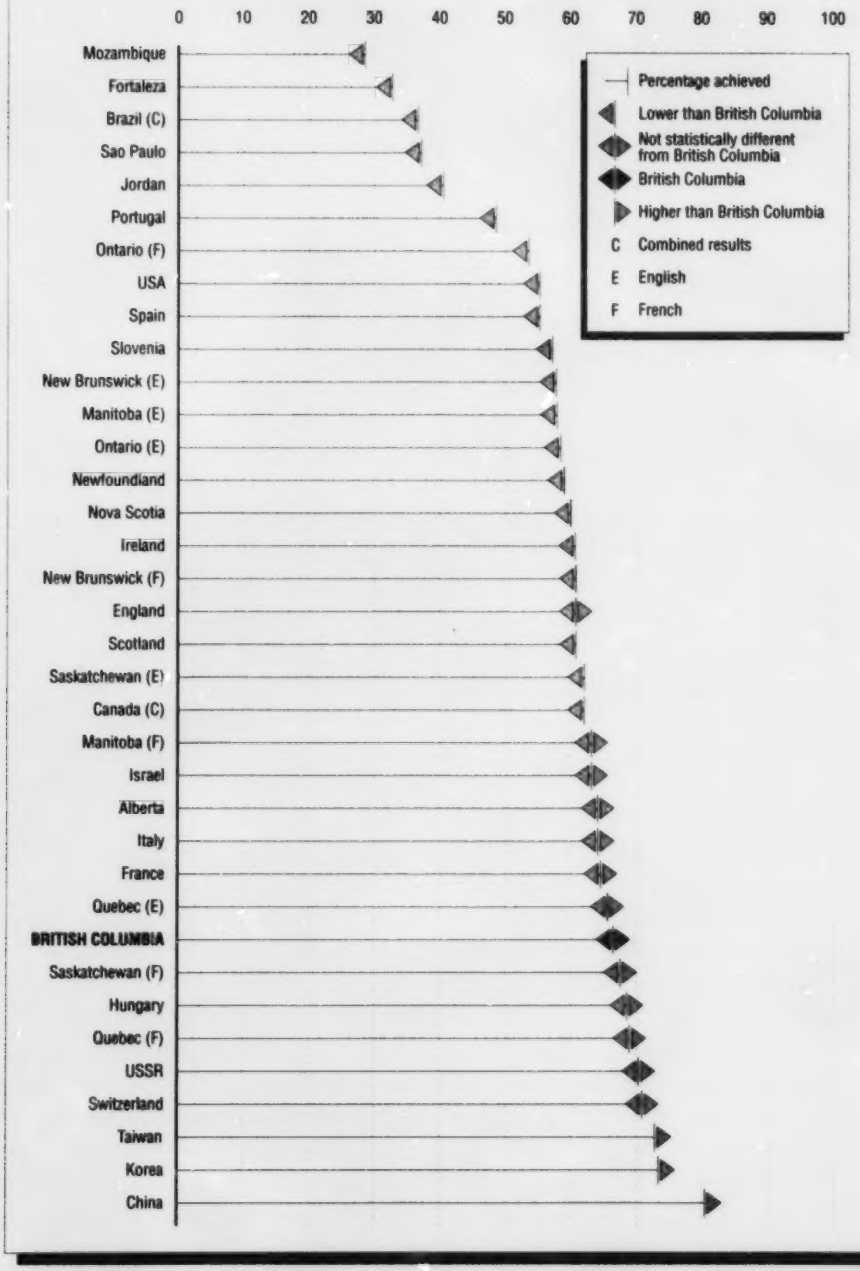
The mathematics assessment for 13-year-olds consisted of 76 items, one of which was removed from the analysis; three-quarters of the items were multiple-choice and one-quarter of the items were open-ended. Five content areas were examined on this assessment: Numbers and Operations; Measurement; Geometry; Data Analysis, Statistics, and Probability; and Algebra and Functions. The cognitive processes assessed in the mathematics assessment were classified as: Conceptual Understanding, Procedural Knowledge, and Problem Solving.

Overall Mathematics Results

The average score on the mathematics assessment for 13-year-olds is 58 per cent. As shown in Figure 1, British Columbia students scored 66 per cent, ninth out of 34 populations, highest of the English-speaking populations, and 4 per cent higher than the Canadian average. China's students (in-school population only - see Participants, page 5) received the highest average score (80%), followed by Korea (73%) and Taiwan (73%). These three scores are statistically significantly higher (see Statistical Significance, page 7) than British Columbia's score; however, there is no statistically significant difference between British Columbia's score and twelve other jurisdictions. The average

scores on the mathematics assessment range from 28 per cent to 80 per cent.

Figure 1. Mathematics, age 13: Average per cent correct by jurisdiction



When only the jurisdictions that participated in the First IAEP (see History, page 6) are considered, British Columbia maintained the same position in the mathematics component of the Second IAEP as it occupied in the mathematics component of the First IAEP. British Columbia students scored moderately behind Korea and Quebec (French), and ahead of all other jurisdictions.

High and Low Achievers

Overall the scores of the high and low achievers in each jurisdiction reflect the average scores. However, as noted in *Learning Mathematics*, "the technological leaders of the 21st century will probably come from the highest-performing students in schools today" (page 20). British Columbia students in the 95th percentile scored an average of 95 per cent. Only students in the 95th percentile in China (in-school population only), Korea, Taiwan, and Hungary scored higher.

British Columbia and other jurisdictions are also concerned that the education system is serving all students equitably. British Columbia students in the 5th percentile achieved higher average scores than students in the 5th percentile in all other jurisdictions with the exception of China (in-school population only), Switzerland, Quebec (French), and Saskatchewan (French).

Mathematics Performance by Gender

In the majority of populations, including British Columbia, performance and gender are not significantly related. Exceptions to this pattern are indicated by Switzerland, France, Italy (Emilia-Romagna), Ireland, Spain, China, Brazil (Fortaleza), and Canada (taken as a whole) where the boys significantly out-performed the girls on the IAEP mathematics assessment. British Columbia boys scored an average of 67 per cent, and the girls scored an average of 65 per cent. Although the boys' average score is higher than the girls' average score, the difference is not statistically significant. Newfoundland is the only jurisdiction where the girls significantly out-performed the boys.

In British Columbia, 95 per cent of students report that mathematics is for boys and girls equally; in most jurisdictions over 90 per cent of students agree with this statement. In five populations - Korea, Taiwan, Jordan, the Soviet Union, and Mozambique - 56 per cent to 84 per cent of the students believe mathematics is for boys and girls equally; yet in none of these populations did boys significantly out-perform girls.

Topic Areas and Cognitive Processes

The topics and cognitive processes tested on the IAEP mathematics assessment were based on a consensus of important curricular topics in most jurisdictions (see Test Construction, page 8). The participants agreed these topics were reflective of their curricula, though emphasized to differing degrees, and appropriate for testing 13-year-olds.

On the mathematics assessment, British Columbia students performed strongest in Data Analysis, Statistics, and Probability, in which they rank sixth overall with an average score of 80 percent. As shown in Table 1, British Columbia students scored significantly higher than the IAEP average in all topics and cognitive processes.

Table 1: Mathematics Results for 13-Year-Olds by Topic and Cognitive Process

	B. C. Average (%)	IAEP Average (%)	Difference (%)
Topics			
Numbers and Operations	69 *	61	8
Measurement	54 *	47	7
Geometry	70 *	62	8
Data Analysis, Statistics, and Probability	80 *	69	11
Algebra and Functions	60 *	54	6
Cognitive Processes			
Conceptual Understanding	69 *	61	8
Procedural Knowledge	68 *	58	10
Problem Solving	62 *	56	6

* Significantly higher than the IAEP average.

Classroom Variables

Student achievement is dependent on many interwoven variables. The IAEP surveyed some of the classroom variables that affect student performance: amount of time spent on mathematics instruction, group work, frequency of mathematics tests, teaching materials, teacher background, and ability groupings. The results indicate the effect of these variables on student performance may not be the same in all jurisdictions.

Amount of Time Spent on Mathematics Instruction

Most jurisdictions in the IAEP report an average of between 200 and 250 minutes a week on mathematics instruction. British Columbia is consistent with this pattern, spending an average of 200 minutes a week on mathematics instruction. Top-ranking China (in-school population only) spends an average of 300 minutes a week, 75 minutes higher than average. However, second ranking Korea spends only 180 minutes a week on mathematics instruction, about 45 minutes below average.

In the majority of populations, over 50 per cent of the students report that their teacher lectures on mathematics every day. In British Columbia, 37 per cent of the 13-year-olds report that they listen to a mathematics lesson every day, and an additional 56 per cent report that they listen to mathematics lessons several times a week.

Thirty-four per cent of British Columbia students report that they work independently on mathematics exercises every day. The percentage of students that reported doing mathematics exercises every day in other jurisdictions ranged from 10 per cent in Italy (Emilia-Romagna) to 78 per cent in China (in-school population only).

Group Work

In British Columbia 44 per cent of students report participating in group work at least once a week. In other jurisdictions, anywhere from 21 to 83 per cent of students report doing so.

Frequency of Mathematics Tests

Mathematics tests and quizzes are used frequently in several of the participating jurisdictions, including British Columbia, where 54 per cent of the students report taking tests at least once a week. Most participants in the IAEP use tests and quizzes on a less frequent basis.

Teaching Materials

Although students and teachers report having access to different teaching tools (such as counting blocks, geometric shapes, calculators and computers) for mathematics, the results suggest these materials are not widely used in classroom instruction.

In British Columbia, 11 per cent of the 13-year-olds report using tools once a week. The use of mathematics tools is infrequent among all participating populations, except Mozambique (70%) and Slovenia (63%).

Ninety-two per cent of 13-year-olds in British Columbia report owning a calculator, and 83 per cent report using one for school and homework. The majority of 13-year-olds in most jurisdictions report they have a calculator. However, reported use of calculators in school is considerably lower than reported ownership in some jurisdictions. Calculators are most commonly used in schools in France, England, Scotland, and several Canadian provinces including British Columbia.

Approximately 50 to 60 per cent of the students from France, Israel, Slovenia, British Columbia, Alberta, Ontario (English), and Saskatchewan (English) report using a computer for homework. In all other jurisdictions, fewer than 50 per cent of the students report using computers for homework.

Teacher Background

In British Columbia, 58 per cent of the teachers teaching mathematics are primarily mathematics teachers. In most jurisdictions, mathematics is taught by teachers who teach mathematics most of the time; the exceptions are Switzerland, Italy, and several Canadian jurisdictions.

There is no consistent relationship between student performance and teachers receiving post-secondary training in mathematics. In ten jurisdictions the majority of schools reported that all mathematics teachers have taken some post-secondary mathematics courses. In British Columbia, 58 per cent of the teachers have taken post-secondary mathematics courses. In Hungary, 100 per cent of the teachers have taken some post-secondary mathematics courses, while 12 per cent of Korea's teachers have done so.

Ability Groupings

Most jurisdictions, including British Columbia (26%), report that fewer than half of their classrooms are organized according to ability. However, five of the participating jurisdictions organize the majority of their classrooms in this fashion: England (92%), Israel (74%), Ireland (67%), Taiwan (63%), and the United States (56%). Of these jurisdictions, only students from Taiwan scored above the IAEP average.

The Science Assessment

The tests given to 13-year-olds for the science assessment consisted of 72 multiple-choice items, of which eight were removed from scoring. Students were tested on four topics (Life Sciences, Physical Sciences, Earth and Space Sciences, and Nature of Science), and three cognitive processes (Knows Science, Uses Science, and Integrates Science). While these topics and cognitive processes are common to the curricula of all jurisdictions, they receive varying degrees of emphasis.

Overall Science Results

As shown by Figure 2, British Columbia students, with an average score of 72 per cent, ranked second to Alberta students among the 12 English-speaking jurisdictions. When compared to all 33 participating populations, British Columbia ranked sixth. Korea and Taiwan scored significantly higher than British Columbia; 10 other jurisdictions did not score significantly differently from British Columbia when the margin of error is considered. The average score for Canada is 69 per cent; the overall IAEP average for all participating countries is 67 per cent. The range of average scores for all participating jurisdictions is 46-78 per cent.

British Columbia, which was first in the science component of IAEP I, was second in IAEP II, when only the jurisdictions that participated in both IAEP I and II are considered.

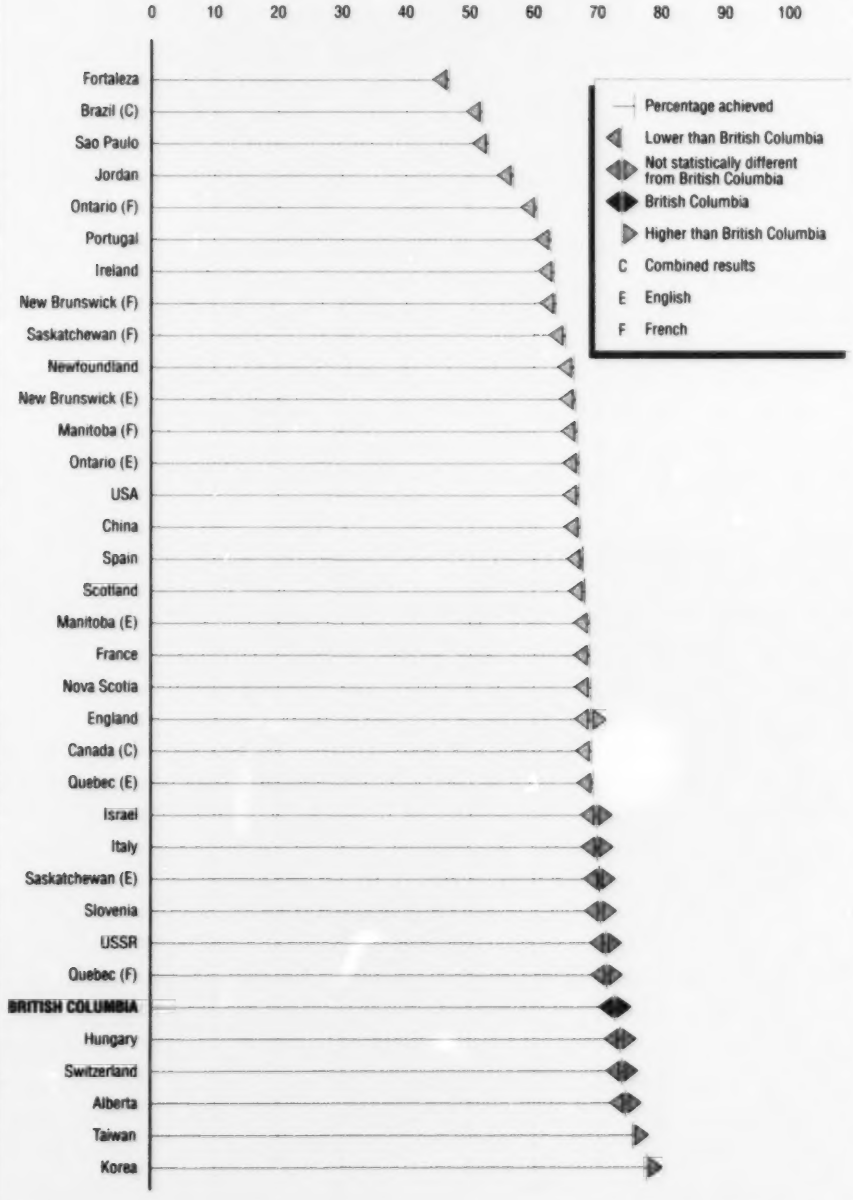
High and Low Achievers

Overall, the scores of the high and low achievers in each jurisdiction reflect the average scores. Most jurisdictions show a particular concern for their best students, who are expected to play a leading role in science and technology. British Columbia students in the 95th percentile scored an average of 92 per cent on the science assessment. Only the students in the 95th percentile in Hungary, Korea, Switzerland, Taiwan, and Alberta scored higher.

British Columbia and other jurisdictions are also concerned that the education system is serving all students equitably. British Columbia students in the 5th percentile scored higher than the

students in the 5th percentile of other participating populations, with the exception of Switzerland, Korea and Alberta.

Figure 2. Science, age 13: Average per cent correct by jurisdiction



Science Performance by Gender

In almost every population boys significantly out-performed girls in the science assessment. British Columbia boys, with an average score of 74 per cent, significantly out-performed British Columbia girls, with an average score of 71 per cent.

There is strong agreement by both genders in most populations that science is equally important for boys and girls. Ninety-four per cent of British Columbia students report that they believe that science is equally important for both genders.

Topic Areas and Cognitive Processes

As shown in Table 2, all topic and cognitive process scores for British Columbia students are higher than the IAEP averages. British Columbia students excelled in Nature of Science with an average score of 81 per cent, ranking second overall.

Table 2: Science Results for 13-Year-Olds By Topic and Cognitive Process

	B.C. Average (%)	IAEP Average (%)	Difference (%)
Topics			
Life Sciences	70 *	68	2
Physical Sciences	71 *	64	7
Earth and Space Sciences	72 *	67	5
Nature of Science	81 *	71	10
Cognitive Processes			
Knows	76 *	73	3
Uses	70 *	65	5
Integrates	74 *	65	9

* Significantly higher than the IAEP average.

Classroom Variables

IAEP II collected data on a number of classroom variables that may relate to student performance, including: time spent on science instruction, time spent listening to the teacher give a science lesson, and student-conducted experiments.

Amount of Time Spent on Science Instruction

In most participating populations educators report that 13-year-olds receive approximately 30 to 40 minutes of science instruction every day. British Columbia educators report an average of 188 minutes of science instruction a week, or approximately 38 minutes of science instruction every day.

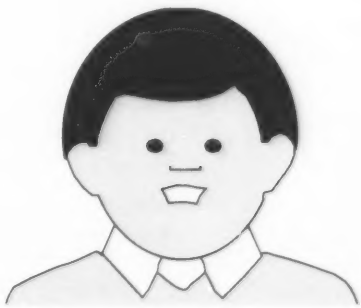
In British Columbia 29 per cent of students report listening to the teacher give a science lesson every day. In three countries, the Soviet Union, the United States, and Jordan, the majority of students report listening to science presentations daily.

Student-Conducted Experiments

The IAEP student questionnaire revealed that students in most populations infrequently conduct science experiments in the classroom on their own. In seven of the populations about one quarter of the students report that they never perform experiments on their own. In British Columbia, 55 per cent of the students report that, at least once a week, they do experiments on their own.

Students and Their Homes

Both the mathematics and science IAEP questionnaires included questions about the student's home life.



Parental Involvement

In British Columbia, 57 per cent of the students report talking about science class with someone at home; 61 per cent of the students report talking about mathematics class with someone at home. In other jurisdictions, 43 to 89 per cent of the students report talking to someone at home about science and mathematics classes.

While 70 per cent of British Columbia students report that they receive help with their mathematics homework, 55 per cent of them report receiving help with their science homework.

Between 14 and 80 per cent of the students in other jurisdictions report receiving help with science and mathematics homework.

Number of Books In the Home

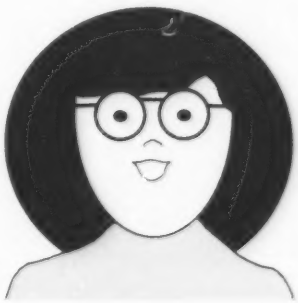
The IAEP questionnaire surveyed students about the number of books available in their homes. The number of books available to a student may be used as an indicator of social and economic status, and may also determine the extent to which a student has the opportunity to learn outside school.

Most (90%) of British Columbia students indicate that they have more than 25 books at home. Between 45 and 91 per cent of students in other jurisdictions indicate that they have more than 25 books at home.

The results from the IAEP survey indicate a positive correlation in nearly all participating countries between the number of books in the home and both mathematics and science performance.

Out-of-School Activities

To examine the relationship between out-of-school activities and performance in mathematics and science, IAEP II asked the 13-year-old students how much time they spend reading for fun, doing homework, and viewing television.



Reading for Fun

In British Columbia 39 per cent of students report that they read for fun almost every day. The lowest and highest reported percentages both come from jurisdictions that performed very well in the assessment: Korea (11%) and Switzerland (50%).

The IAEP results indicate that the students who read for fun tend to be the higher performers in most jurisdictions.

Homework

In British Columbia 73 per cent of students report doing homework one hour or less a night. The IAEP results indicate that most 13-year-old students spend an average of "one hour or less" a night on homework for all subjects.

The relationship between the amount of time spent on homework and performance on the IAEP is not clear. About half of the populations show a positive correlation between performance and time spent on homework. However, several Canadian jurisdictions show a negative correlation between these variables, and other populations, including British Columbia, show no relationship.

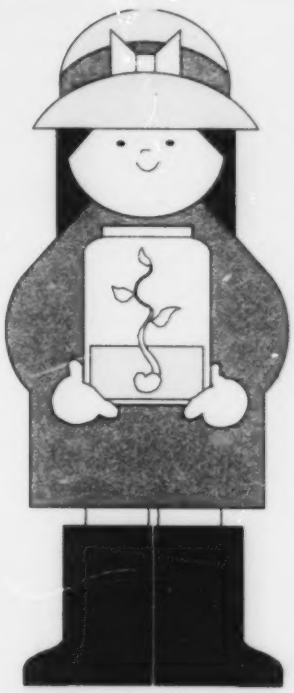
Television

Television is a common out-of-school activity for 13-year-olds in most populations. Most student populations report an average of 2 to 4 hours of television a night. In British Columbia, 64 per cent of the students report viewing 2 to 4 hours of television nightly, 23 per cent report viewing no or 1 hour of television nightly, while 13 per cent report viewing 5 hours or more television nightly.

The results for students in British Columbia indicate a negative correlation between performance and the amount of television watched. In other words, students who spend a great deal of time watching television tend to perform less well than those who spent less time watching television. All populations, except Portugal, indicate either a negative correlation or no correlation between time spent viewing television and level of achievement.

ASSESSMENT RESULTS OF NINE-YEAR-OLDS

IAEP II tested and surveyed 9-year-olds on the same topic areas and cognitive processes as the assessment of 13-year-olds.



The Mathematics Assessment

The mathematics assessment of 9-year-olds consisted of 62 items, one of which was removed from the analysis, and a survey that asked students about their home and school experiences. Topic areas covered by the mathematics test were Numbers and Operations, Measurement, Geometry, Data Analysis, Statistics and Probability, and Algebra and Functions; cognitive processes tested by the assessment were Conceptual Understanding, Procedural Knowledge, and Problem Solving.

Overall Results

Unlike the results of the other parts of IAEP II, the performance of British Columbia 9-year-old students on the mathematics assessment is approximately the same as the IAEP average. The British Columbia average is 62 per cent; the international average for the IAEP is 63 per cent. As shown in Figure 3, British Columbia ranks 10th out of 19 jurisdictions, and third among the English-speaking jurisdictions. The jurisdiction scoring highest is Korea, with an average score of 75 per cent. The average score for Canada is 60 per cent.

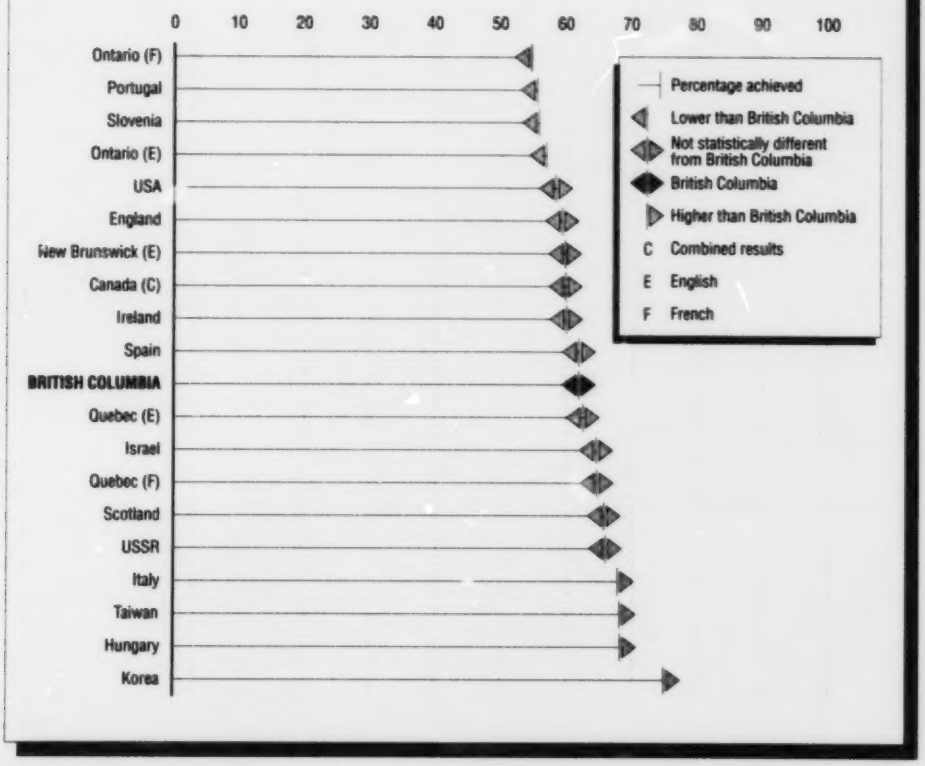
Mathematics Performance by Gender

Boys and girls in British Columbia performed equally well on the mathematics assessment. Differences in performance between

boys and girls on the mathematics assessment are not as prevalent at age 9 as at age 13. In only three populations did boys significantly outperform girls: Korea, Italy, and Israel.

In British Columbia 88 per cent of 9-year-old students agree that mathematics is equally important for both genders. Agreement ranged from 48 per cent to 90 per cent, with all but two jurisdictions having at least 75 per cent agreement.

Figure 3. Mathematics, age 9: Average per cent correct by jurisdiction



Topic Areas and Cognitive Processes

In topic areas and cognitive processes, British Columbia students were in all cases within 5 per cent of the IAEP average (see Table 3). British Columbia students performed best on the Data Analysis, Statistics, and Probability section of the assessment, and least well in the Algebra and Functions section.

Table 3: Mathematics Results for 9-Year-Olds by Topic and Cognitive Process

	B. C. Average (%)	IAEP Average (%)	Difference (%)
Topics			
Numbers and Operations	59 **	61	-2
Measurement	67	67	0
Geometry	62	64	-2
Data Analysis, Statistics, and Probability	72 *	68	4
Algebra and Functions	57 **	62	-5
Cognitive Processes			
Conceptual Understanding	62	63	-1
Procedural Knowledge	64 **	67	-3
Problem Solving	59	59	0

* Significantly higher than the IAEP average.

** Significantly lower than the IAEP average.

Classroom Variables

IAEP II collected data on a number of classroom variables that may relate to student performance. The data were collected for the following variables: independent exercises, mathematics tools, and ability groupings.

Independent Exercises

One half of British Columbia students indicate that they often do independent work in the classroom. This is consistent with the other participating populations in which approximately 40 to 70 per cent of students indicate they often do independent work. Korean (23%) and Portuguese (32%) students report doing less independent work.

Mathematics Tools

In British Columbia 13 per cent of 9-year-old students report using mathematics tools such as blocks, shapes and solids. The highest percentage of 9-year-old students who report using mathematics tools is in Taiwan (30%).

The use of mathematics tools is more prevalent at age 9 than at age 13, yet only 10 to 30 per cent of 9-year-olds indicate frequent use of mathematics tools.

Ability Groupings

Results from the IAEP survey indicate that grouping 9-year-old students by ability in mathematics occurs in all participating populations to varying degrees. In Scotland 78 per cent of schools report grouping students by mathematical performance, as do 40 to 60 per cent of school in 10 other jurisdictions. In British Columbia 31 per cent of the schools report that they group students by their mathematical ability.

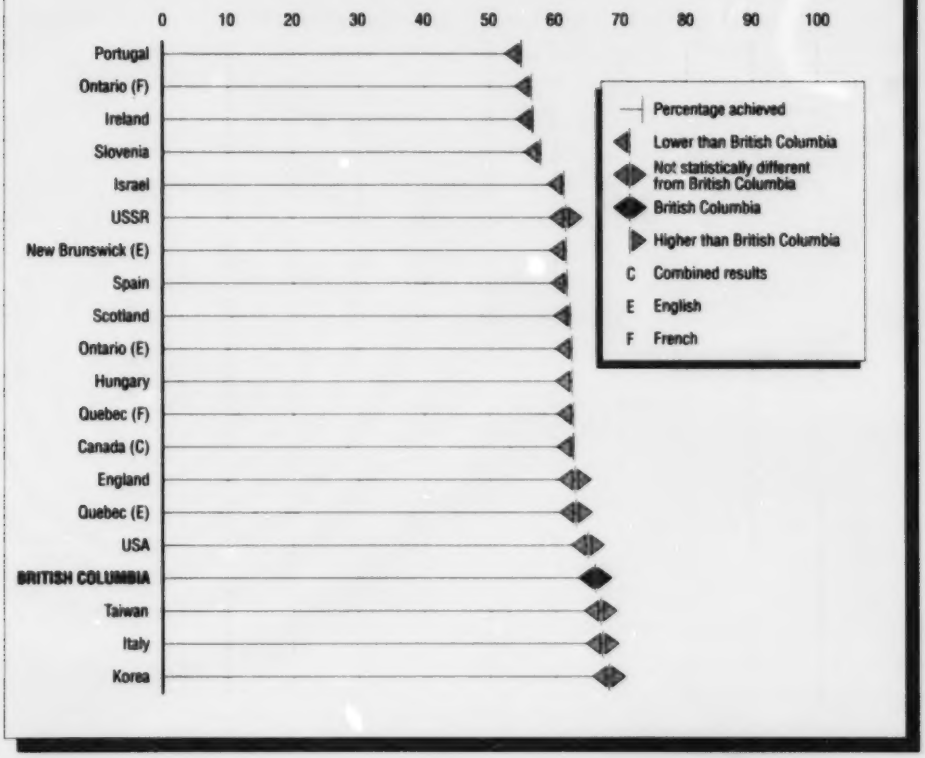
The Science Assessment

The science test administered to 9-year-olds consisted of 60 items, two of which were removed from the analysis. Topic areas tested were Life Sciences, Physical Sciences, Earth and Space Sciences, and Nature of Science; cognitive areas tested were Knows Science, Uses Science, and Integrates Science.

Overall Results

The results from the science assessment of 9-year-olds are similar to the science assessment of 13-year-olds. With an average score of 66 per cent, BC ranks fourth among the 19 jurisdictions participating, and first among the eight English-speaking jurisdictions. Although Korea, Italy (Emilia-Romagna), and Taiwan rank higher than British Columbia, their average scores are not statistically significantly different from British Columbia's average score, as shown in Figure 4. The overall IAEP average score is 62 per cent; scores range from 55 to 68 per cent.

Figure 4. Science, age 9:
Average per cent correct by jurisdiction



Science Performance by Gender

While boys outperform girls in most jurisdictions in the 13-year-old science assessment, they do so in only 9 of 19 jurisdictions in the 9-year-old assessment. British Columbia boys and girls scored equally well on the 9-year-old science assessment.

In British Columbia 86 per cent of 9-year-olds agree that science is equally important for boys and girls. This percentage is consistent with the majority of populations surveyed during the IAEP. Korea (43%) and Ontario (French) (67%) are the only jurisdictions where fewer than 75 per cent of the students agree with the statement.

Topic Areas and Cognitive Processes

Scores in topic areas and cognitive processes are consistent with overall science scores for most participating populations. As shown in Table 4, in a number of areas British Columbia students scored relatively higher than the average score. They rank first in Earth and Space Sciences (72%), third in Nature of Science (70%), third in Life Sciences (66%), and sixth in Physical Sciences (60%). In the cognitive areas, British Columbia average scores were from 2 per cent to 4 per cent higher than the IAEP averages.

Table 4: Science Results for 9-Year-Olds by Topic and Cognitive Process

	B. C. Average (%)	IAEP Average (%)	Difference (%)
Topics			
Life Sciences	66 *	63	3
Physical Sciences	60	59	1
Earth and Space Sciences	72 *	64	8
Nature of Science	70 *	64	6
Cognitive Processes			
Knows	68 *	64	4
Uses	67 *	63	4
Integrates	59	57	2

* Significantly higher than the IAEP average.

Classroom Variables

There are many similarities and some differences among jurisdictions with respect to how science classes for 9-year-olds are conducted.

Reading In Class

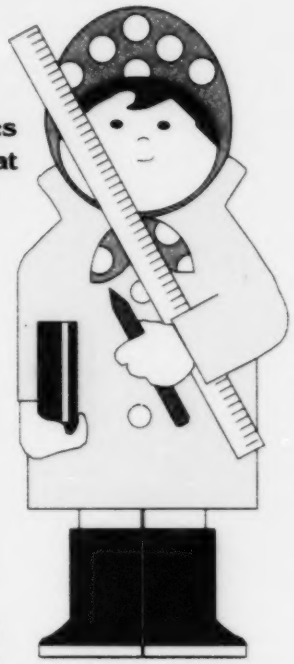
In British Columbia 24 per cent of 9-year-olds report reading books about science at school often. Between 17 per cent and 40 per cent of students from all jurisdictions report reading books about science at school often.

Science Experiments

In British Columbia, 21 per cent of students report that they never conduct science experiments. In other jurisdictions, between 10 per cent and 50 per cent of the 9-year-old students report never conducting science experiments.

Out-of-School Activities

The questionnaire also asked 9-year-old students about their participation in such out-of-school activities as reading for fun, television viewing, and homework. Responses on the IAEP student questionnaire suggest that the out-of-school activities of 9-year-olds are different from those of 13-year-olds.



Reading for Fun

The number of students who read for fun every day is greater in the 9-year-old IAEP population than in the 13-year-old IAEP population. Fifty-two per cent of British Columbia students report reading for fun almost every day, compared with 25 to 64 per cent of 9-year-olds in other jurisdictions.

For the majority of IAEP populations, reading for fun and performance in mathematics and science are positively correlated. The only exceptions are Slovenia and Portugal, where no relationship exists between leisure reading and performance.

Homework

The most common response regarding the amount of time 9-year-old students spend doing homework for all subjects is "less than one hour a day". In British Columbia 13 per cent of students report doing two hours or more homework a day. In Taiwan, the Soviet Union, Spain, and Israel approximately 30 per cent of the student population reports doing two hours or more homework a night.

Television

In all participating populations, viewing five hours or more of television a day is more common for 9-year-olds than for 13-year-olds. In British Columbia 21 per cent of the 9-year-olds, compared with 13 per cent of the 13-year-olds, watch five hours or more television a day. In Israel, Ireland, Canada (as a whole), the United States, Scotland, and England, 20 to 25 per cent of the 9-year-old students spend five hours or more a day viewing television. An additional 51 per cent of 9-year-olds in British Columbia, and a similar percentage in other jurisdictions, indicate that they watch between 2 and 4 hours of television every day.